JOURNAL *of* THE SOCIETY OF CHEMICAL INDUSTRY

CHEMISTRY & INDUSTRY

Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council for Chemistry

which consists of Representstives from

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VOL. 52 LONDON, JUNE 9, 1933 NO. 2

EDITORIAL

Man and Metals

THERE are many kinds of study and many kinds of books. The first in importance is the study made to enable man to earn his income or to increase it. The investor reads the statistics of the Ottoman Railway and the Anglo-Portuguese Telegraph Company; the lawyer reads his Law Reports, and so on. Next in importance is the study of those subjects that improve man's general knowledge without hope or desire of any base pecuniary return for the time spent, and of all such profitless subjects—from the narrow financial view—one of the most fascinating is the history of man, his progress, and development. Whether we consider his race, his language, his art, his domestic animals, his agriculture, his food, or his general civilization, there is an enormons mass of material preserved from past ages and available for our interpretation. The early history of metallurgy is an excellent field in which to delve and there are few so well qualified to write about it as Dr. T. A. Rickard whose book on Man and Metals has recently been published hy the McGraw-Hill Book Company. Dr. Rickard has for thirty-five or forty years, or some such time, studied the mining of metals in many parts of the world and has written a good deal about mining; this is a valuable start for an author who engages on a history of mining in relation to the development of civilization; another advantage that he possesses is that he can write on technical matters in good, readable, plain English; he has studied this subject also for many years and written admirable books and articles on this rather neglected art. A third qualification that he seems to possess is a very considerable acquaintance with the early Latin and other authors, who a few centuries ago wrote on mines and metals, and with the recent commentaries on them, and with the most modern publications by the most careful and learned workers on the Babylonian, Egyptian, Greek, Phœnician, and Latin archæology. The result is a two-volume book, expensive it is true, but well written and we printed, that is a storehouse of information on neolithi man, copper and brass, the Cassiterides, the ruins c Zimbabwe in Rhodesia, Ophir and Tarshish, leac mining in Britain in the time of the Romans, iron i ancient times, steel in modern times, gold-mining i California and a very great variety of other interestin and important topics. It is an excellent book to posses and is fortified with abundant illustrations and refe ences. We do not know whether Dr. Rickard propos to issue a companion volume on Woman and the No Metals, upon which a good deal might be writte Much time is very pleasantly spent by some peop in solving cross-word puzzles; the slight difficult in connexion with them accounts for the charm of th pastime; the same sort of ingenuity is required in tl study of such a question as the Cassiterides; the clu are vague and ambiguous and there are many missi words in which there are not even anagrams to he you. As, broadly speaking, the ancient Phœnicia writings have all disappeared, as the Greeks and Roma did not really distinguish between the different kin of metals and as, prior to the time of Julius Cæsa they knew nothing about the geography of the Atlant coast and were ready to believe anything they hea about it we need not be surprised to find that son patience is necessary to glean the truth from a numb of contradictory and inaccurate statements, casual preserved or, in some cases, very casually quote We believe that Dr. Rickard has performed this ta as well as anyone could do it; if any critic disagre with his conclusions, we think the critic should furni evidence of a study of mining, archæology, and histo over a period of at least thirty years before we beg to test his knowledge of etymology, Latin, Sumeria and other languages. It must have been a delightf thing to study the subject so long and write such pleasant book to read. It will be invaluable to tho who are curious about the history of science.

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MANCHESTER SCIENTISTS OF FORMER DAYS
I. CHEMISTS

By PROF. J. R. PARTINGTON, D.SC.

Some years ago I was invited to give a short lecture to Manchester chemists on notable men who had worked at chemistry and physics in their city, and the following two articles are based on the material then collected. My colleagues at the time expressed their appreciation of the lecture and its publication may revive memories of great names which have been associated with science in Manchester. I begin with Percival.

Thomas Percival, the founder of the Manchester Literary and Philosophical Society, was born at Warrington in 1740. His uncle was a physician who had been a pupil of Boerhaave; his father followed "various branches of commerce," as his son puts it, and the latter elected, when another uncle left him a small competency, to follow the medical profession. He is said to have been the first student enrolled in the once famous Warrington Academy which was opened in 1757. Priestley taught there from 1761 to 1767 and there began his "History of Electricity." Percival, who could not proceed to Oxford on account of his inability to subscribe to the Thirty-nine Articles, went to Edinburgh, where he boarded with a sister of Robertson, later Principal of Edinburgh University. Percival afterwards obtained from Robertson a Doctor's degree for Priestley. During his student days at Edinburgh, Percival visited London and was in 1765 elected a Fellow of the Royal Society through the influence of Lord Willoughby of Parham, the first president of the Warrington Academy, who was then vice-president of the Royal Society. Percival had made a tour of the Continent and had visited Leyden, where he took the degree of M.D. for a dissertation entitled *De Frigore*, which was published in 1765. After spending two years in Warrington he decided to settle in practice in London, but considered it better to obtain some preliminary experience in Manchester. He went there in 1767, and stayed for the rest of his life. He had an excellent practice and was said to be one of the three owners of carriages in the town.

Percival's scientific publications, which are not important, appeared partly in the *Philosophical Transactions* and partly in three volumes of "Essays Medical and Experimental," issued in 1767 to 1776. They included experiments on Peruvian bark, the strength of its preparations being measured by the colour produced with iron salts, on ink, on cantharides, on hard water (which he knew produced goitre), on columbo root, on orchis root, on calculi, and many other subjects. He particularly condemned tea, which he said was the cause of a great many ailments previously unknown, although some of these might be due to drinking spirits, the taste for these being induced by drinking tea, "which by the lowness and depression of spirits it occasions, renders it almost necessary to have recourse to what is cordial and exhilarating." Coffee, however, is praised. In his experiments on hard water, he mentioned that he could not confirm Boyle's observation that it softened by exposure to the air for a few days. The hardness was estimated by the curdling of soap, and beer had the same effect as the water used in its preparation He thought that lead should be more attacked by hard water than by soft, but to his surprise the opposite was the case. A favourite subject of Percival's and later of Thomas Henry's, was the effect of various substances in promoting or arresting putrefaction.

Percival made use of cod-liver oil and said nearly a hogshead a year was dispensed in the Manchester Hospital. He used it raw, and also in the form of an emulsion made with soap, an acid being given afterwards to break down the emulsion and liberate the oil. Percival was greatly interested in functions which now belong to a Medical Officer of Health, and published a number of vital statistics. Half those born in Manchester, he found, died under five years of age, which was better, however, than the condition in Liverpool or London. He was also interested in the Factory Acts, and the conditions he saw led him to propose the then unheard-of step of legislative interference with the working of factories.

In those days Manchester was already an important centre of instruction which attracted men from different places, many of these meeting at Percival's house weekly. As the number grew, the meetings adjourned to a tavern, a few rules were drawn up, and the Literary and Philosophical Society was founded in 1781. Among its first members were Darwin, Priestley, Bishop Watson, Josiah Wedgwood, and two foreigners, Lavoisier and Volta. Percival afterwards was president. In 1783 he founded a Dissenting Academy in Manchester on the lines of the then nearly defunct institution at Warrington. This migrated to York in 1802, but during its Manchester days John Dalton taught mathematics and natural philosophy there.

Thomas Henry was descended from a family which for several generations had lived at Antrim. His paternal grandfather, who commanded a company of foot under King James II, was murdered in his garden, and his infant son, the father of Thomas, was taken care of by a neighbouring nobleman, Viscount Bulkley, who educated him in Dublin and brought him over to Wales, where at Wrexham he and his wife conducted a boarding school. Thomas was born at Wrexham in 1734. He was educated at Wrexham Grammar School and it was at first intended that he should go to Oxford and enter the Church. His parents, however, were not able to afford this, so that Thomas was apprenticed to an apothecary at Wrexham. He served apothecaries at Knutsford and Oxford, and settled at Knutsford in 1759. In 1764 he removed to Manchester, where he came in contact with Percival. He became President of the Literary and Philosophical Society in 1807, a Fellow of the Royal Society in 1775, and died in 1816 at the age of 82.

During his apprenticeship Thomas Henry showed a taste for chemistry, but the only book he was able to borrow was the Latin edition of Boerhaave's Chemistry, a work which, as his son William says, "was certainly not calculated to present that science to a beginner under a fascinating aspect." In 1771 he published a paper on an improved method of preparing magnesia, in which he obtained the oxide by calcination. He afterwards manufactured this, and "Henry's magnesia"

was a familiar domestic remedy. In 1776 he translated Lavoisier's Essays with notes, and in 1783 he translated some of Lavoisier's memoirs. He thus shared with Robert Kerr (who translated Lavoisier's "Elements of Chemistry" in 1790) the honour of having introduced the new theories of chemistry to this country.

Henry's further experimental work included the observation that fixed air in the pure state killed vegetation whilst in the dilute state it promoted growth. In his experiments on fermentation he thought that fixed air "is the exciting cause as well as the product of fermentation," and he described how wort may be fermented, with the production of yeast (from which he made bread), by impregnating it with fixed air. In one experiment, he said, he prepared some punch with water impregnated with fixed air, and put aside what was left in a corked bottle. "An old gentleman, to whom I gave a half-pint glass of it, called out in raptures to know what delicious liquor he had been drinking, and earnestly desired that if I had any more of the same, I would give him another glass." Percival would not have approved of this invention.

An important essay of Henry's, published in Vol. 3 of the first series of memoirs of the Literary and Philosophical Society, dealt with "Considerations relative to the Nature of Wool, Silk, and Cotton, as objects of the art of Dyeing; on the various Preparations and Mordants requisite for these different substances; and on the Nature and Properties of Colouring Matter—Together with some Observations on the Theory of Dyeing in general and particularly the Turkey-Red." Turkey-red dyeing was said to have been introduced by John Wilson of Ainsworth in 1762, and bleaching was generally introduced into the Manchester district in 1763. Henry adopted a chemical theory of dyeing and suggested that the unequal powers of wool, silk, linen, and cotton for taking up and fixing dyestuffs depended on the different chemical attractions between the fibres and the dyes. The preliminary operations remove extraneous matter which is united with the substance to be dyed, and so prevent it from exerting its full attraction. A mordant is a substance which, having an affinity both for the colour and for the material to be dyed, serves as an intermediate link to bind the two together. Henry pointed out for the first time that the mordant prepared by precipitating sugar of lead with alum is a solution of acetate of alumina, and is superior to alum because of the volatility of the acetic acid and its smaller affinity for the alumina as compared with sulphuric acid.

When the Manchester College of Arts and Sciences was established, Henry gave lectures to practical men on dyeing, bleaching, and calico printing. He also sent a successful petition to Parliament against a monopoly which foreign dyers, exploiting Berthollet's discovery of the use of chlorine in bleaching, were trying to establish. Henry contemplated work on a large scale, but abandoned the project. His son tells us that he never had a properly equipped laboratory.

Better known and more intimately connected with chemistry than his father, Thomas Henry, was his son William, chiefly remembered as the discoverer of Henry's law. He was born in Manchester in 1774, and was therefore the first of the scientists mentioned who was actually born in the city. He became interested in chemistry at an early age, and an accident which befell him when a young boy unfitted him for games and turned his attention to books and experiments. He entered Percival's house, and in after life Henry refers with gratitude to the help Percival gave him. After five years he left Percival and practised with Dr. Ferriar at the Manchester Infirmary, and then, in the winter of 1795—6, he entered the University of Edinburgh, where the chemical chair was still filled by Dr. Black, whose lectures Henry attended with great delight. There were many distinguished men, both teachers and students, at Edinburgh with Henry. Lord Kelvin was a fellow pupil of his. He took the degree of M.D. at Edinburgh in 1807, although before this he had left the University for a time and had made several important contributions to science. He became a Fellow of the Royal Society in 1809. In 1800 Henry described the action of electric sparks on muriatic acid gas, but his first important paper was that published in the *Philosophical Transactions* for 1803, in which he announced what is now called Henry's law. He mentioned that Dalton had given him advice in his experiments. The result, as Henry stated it, was "that under equal circumstances of temperature water takes up in all cases the same volume of condensed gas as of gas under ordinary pressure." By combining this with Boyle's law, he shows that "it follows that water takes up, of gas condensed by one, two or more additional atmospheres, a quantity which, ordinarily compressed, would be equal to twice, thrice, etc. the volume absorbed under the common pressure of the atmosphere."

In the year 1803 we know that Dalton was in possession of the Atomic Theory. In that year he read a paper to the Literary and Philosophical Society in which he describes the solubility of gases in water in which he extends Henry's law to mixed gases by the famous Law of Partial Pressures. We are not sure how Dalton was led to this work, but it may have been Henry's experiments, in which we have seen he was interested, that started Dalton on that line of thought and experiment which culminated in the Atomic Theory, and he referred to Henry's discovery in the memoir. In adopting a purely mechanical theory for the absorption of gases, Dalton was met by the difficulty that water does not absorb equal volumes of different gases. "I am nearly persuaded," he said, "that the circumstance depends upon the weight and number of the ultimate particles of the several gases; those whose particles are lightest and single being least absorbable, and the others more, according as they increase in weight and complexity. An inquiry into the relative weights of the ultimate particles of bodies is a subject, as far as I know, entirely new; I have lately been prosecuting this inquiry with remarkable success. The principle cannot be entered upon in this paper; but I shall just subjoin the results, as far as they appear to be ascertained by my experiments." Then followed the first table of atomic weights, which was in existence before the Law of Multiple Proportions, or the experiments on marsh gas and ethylene.

Thomas Thomson in his "History of Chemistry," referred to the analytical skill of William Henry and said that if he had devoted himself to pure science his reputation would have been even higher, "although the celebrity of Dr. Henry, even under the disadvantages of being a manufacturing chemist, is deservedly very high." Angus Smith says Henry was better known in Manchester than Dalton. The latter was very retiring and could hardly have become known outside a small circle of friends, whilst Henry was a more active and sociable man.

In 1805 Henry showed that the combustible gases evolved in the carbonization of coal and wood contained hydrogen, marsh gas, ethylene, and carbonic oxide. The so-called "oxycarbonated hydrogens" of Berthollet were merely mixtures of hydrocarbons with carbonic oxide, and marsh gas was a definite compound and not, as Brande thought even in 1820, a mixture. These results, although not accepted by many chemists, were confirmed by Dalton, Davy, and Berzelius.

In 1809 Henry published a paper in the *Philosophical Transactions* in the form of a letter to Davy, dealing with the composition of ammonia. In it he described the explosion of ammonia with a small amount of oxygen, by which the ammonia was decomposed into its elements, the proportions of which might then be found by adding more oxygen and exploding. In this way he was able to find the composition of the gas. Dry ammonia gas is decomposed by a series of sparks, 100 vol. becoming 180·6 vol. Although nitric oxide will not explode when mixed with hydrogen it will do so when mixed with ammonia. When ammonia is fired with excess of oxygen appreciable amounts of oxides of nitrogen are formed. The care and accuracy of Henry's work are very evident in this paper.

In 1819 Henry described the preparation, purification, and analysis of coal gas. He mentioned that the factory of Philips and Lee at Manchester was lighted with the gas, and that Mr. Lee's private residence was lighted with gas brought from the factory two miles away every day in a portable gas holder on a cart. Henry estimated the hydrogen sulphide in coal gas by test papers coated with white lead, the colour being compared with standards. In 1824 he described a method of analysing gas mixtures by fractional combustion in presence of finely divided platinum. Döbereiner had shown that this acted catalytically in promoting combustion and Henry used it with mixtures of ethylene, marsh gas, carbonic oxide, and hydrogen. Ethylene was first removed by chlorine in the dark, and the residue mixed with oxygen and exposed to platinum sponge at 340° F. The CO and H_2 were burnt out, and from the contraction and potash absorption the composition was found. Marsh gas was not affected until the temperature rose above the boiling point of mercury. This work preceded Faraday's investigations by nearly ten years.

Henry wrote an "Epitome of Chemistry," first published in 1800, which went through several editions and in 1810 appeared in an enlarged form as an "Elements of Experimental Chemistry" in 2 vols., which also went through a number of editions, and is a very good textbook, clear, concise, and practical. A history of chemistry was projected by Henry but he put it off to do in

Henry was awarded the Copley gold medal of the Royal Society in 1809, the year in which his paper on ammonia appeared in the Transactions. Apart from Dalton, who stands quite alone, he was probably the most able of the earlier Manchester chemists. Henry's life ended sadly: he committed suicide in 1836.

Next in point of seniority comes Edward Schunck, although his work was continued long after the men who came after him had ceased to take any active interest in chemistry. He was born in Manchester in 1820, the son of a naturalized German business man. He studied in Germany under Liebig, Rose, and Magnus and after some years he left business and devoted himself to scientific investigation. Most of Schunck's work was in the very difficult field of the natural colouring matters, and an authority has said that "there is hardly one to which he has not contributed some fact of considerable importance." Madder, alizarin, the colours of lichens, indigo, cochineal, and chlorophyll were all investigated, and near the time of his death Schunck was busy with the colour of the blackberry. He was a most orderly worker and it is said that he could not work in comfort with more than four glass vessels on the bench before him. In 1895 he gave to Owens College the sum of £20,000 for chemical research, and on his death he bequeathed to it his private laboratory and library at Kersal, which were removed and rebuilt at the College. As a young student at Manchester I soon came to know the name of Schunck and to read in this library, afterwards doing research in the laboratory.

Schunck was made a D.Sc. of Manchester in 1899; he was for some years president of the Literary and Philosophical Society, and was a vice-president of the Chemical Society, of which he was an original fellow, although I have been unable to find any obituary notice of him in its publications. He received the Davy medal of the Royal Society in 1899.

Schunck isolated from madder root a substance which he called *rubian*. By the action of an enzyme in the root, or by hydrolysis, it was split into sugar and alizarin. Alizarin was analysed and Schunck prepared from it by oxidation an acid which he called *alizaric acid*. This was shown by Gerhardt to be phthalic acid, and for some years alizarin was thought to be a derivative of naphthalene, although Schunck never agreed with this. In 1868 Graebe and Liebermann showed that alizarin can be reduced to anthracene and is really dihydroxyanthraquinone.

Schunck found that the indigo plant, or rather woad, which he found was easily cultivated in England, contained a substance *indican*, which is hydrolyzed into indigo blue and a sugar, in a similar way to rubian. This indican is now considered to be a glucoside of indoxyl. He also carried out important work on chlorophyll, but this was a material of great complexity, and it is not surprising that he did not arrive at that solution of the problem which we owe to Willstätter. When I began to work in the Schunck cellar in 1919 I found there several pots filled with chlorophyll which Schunck had prepared. Schunck worked on some very difficult subjects, and fully deserves remembrance.

Edward Frankland cannot be said to have done very

very distinguished man. He was born in 1825 at Churchtown, near Lancaster, lived for a year at Salford and attended school in Manchester. While there he became interested in chemistry. After a period at Lancaster Grammar School he became apprenticed to a pharmacist and wasted, as he says, six years in making up parcels and pounding drugs and cocoa in a huge mortar in the shop cellar. Prof. H. E. Armstrong told us not long ago that this mortar is still in existence.

In 1845 Frankland entered Dr. Lyon Playfair's laboratory, then attached to the Government Department of Woods and Forests, in Duke Street, Westminster, where he learnt analysis. In 1847 he and Kolbe went to Bunsen's laboratory at Marburg. There Frankland learnt gas analysis and continued some work he and Kolbe had begun in London on the synthesis of fatty acids by boiling the cyanides of organic radicals with strong potash. This work demonstrated the existence of the methyl, ethyl, and other hydrocarbon radicals in the fatty acids, and was very important for the development of chemical theory at the time. Frankland was then appointed at Queenswood College and continued his work both there and at Marburg in the vacations. He tells us, incidentally, that Bunsen was a good lecturer "in the conversational style," although his lecture experiments did not always succeed. In one lecture the poisonous effects of prussic acid were to be demonstrated. Bunsen inserted a bird's beak into a test tube containing the acid, and then, after stating that the bird was dead, released it, expecting it to fall to the ground. Instead, it promptly flew out of the window.

Frankland was then working on the isolation of the hydrocarbon radicals. He heated zinc with ethyl iodide in a sealed tube and found that a gas was produced which had the composition of methyl and was regarded as the free radical. It was really the doubled radical, ethane, C_2H_6. By the action of water and zinc on ethyl iodide he obtained what he thought was ethyl hydride, $C_2H_5 \cdot H$, isomeric with methyl. Frankland then prepared zinc methyl by the action of zinc on methyl iodide and thus obtained the next organo-metallic compound known after Bunsen's cacodyl. Bunsen, he says, was very much pleased with this discovery. At Giessen, Frankland worked with Liebig in 1849. He tells us that he was the only research student in the laboratory. In 1850 he was appointed as successor to Playfair at Putney College, and it was here that he put forward the theory of valency. The paper was communicated to the Royal Society but nothing further was heard of it. Then it was found that Stokes, the secretary, had locked it up in a drawer and forgotten it. It appeared in the Transactions for 1852.

In 1850 an advertisement appeared for a professor of chemistry in the Owens College which was to be formed at Manchester, and Frankland offered himself for the post and was accepted.

The Owens College was founded as the result of a bequest by John Owens, the son of a Flintshire man who had settled in Manchester as a merchant and made a fortune. John Owens had the idea of founding the new college as a protest against the imposition of articles and creeds on students entering the older universities. At his death in 1846 the provisions of his will were carried out and by 1857 the estate was realized and a sum of £96,942 was available for the endowment of the College. The latter had, as a matter of fact, been formally opened in March, 1851. From the beginning it had good educational ideals and was not a mere vocational institution.

Frankland had a temporary lecture room and laboratory fitted up in an empty house in Great John's Street, near the College. After he had collected a sum of £10,000 in a few days by the efforts of 10 Manchester business men, Frankland erected new laboratories attached to Cobden's old house, and lectured on technical chemistry. He was not, however, satisfied with his post, and asked Bence Jones and Tyndall to look out for a new position for him in London. He thus succeeded Stenhouse at St. Bartholomew's Hospital in 1857, after spending only six years in Manchester. He was also professor at the Royal Institution, where he worked with Duppa on acetoacetic ester and other important compounds. Here, however, we must take leave of our dissatisfied professor and pass on to a great name in Manchester chemistry, that of Henry Enfield Roscoe.

Roscoe was a Liverpool man in the sense that his father and grandfather were born there, but he chanced himself to be born in London in 1833. His grandfather was that William Roscoe who was perhaps the first man of distinction to be born within sight of the Mersey on its Lancashire shore. He was the son of a market gardener but became, as we know, a distinguished historian. Henry Enfield Roscoe attended the High School of the Liverpool Institute, where he learnt chemistry from Balmain, the inventor of luminous paint. In 1848 he went to University College, London, where he studied under Graham and Williamson. He graduated in 1853 and then left to go to Heidelberg to work with Bunsen. Here he learnt quantitative analysis and took his doctorate in the highest class after his second session. He then began with Bunsen those famous researches on the chemical action of light which were perhaps his best work. These experiments, which were principally concerned with the union of hydrogen and chlorine under the influence of light, laid the foundations of photochemistry.

In 1856 Roscoe returned to London and set up a private laboratory with Dittmar as his assistant. In 1857, however, at the age of 24, he succeeded Frankland as professor of chemistry in the Owens College. There were then 35 students in all, of whom 15 were in the chemical department. Things were in a bad way, and Roscoe tells a story of how, one evening when he was taking a stroll in the street near the College, a tramp stopped him and asked if it was the workhouse. Roscoe told him it was not at the moment, but if he would come again a little later it might be. The Yorkshire College, Leeds, we remember, was started in a disused Bankruptcy Court which had shortly before been largely consumed by fire.

We know how earnestly and devotedly Roscoe worked for the cause of chemistry and of the College. He gradually enlarged his department until it became too small for the students. In 1867 a town's meeting decided to move the College to a new site. A new constitution was drawn up and approved by Parliament

in 1870. Large laboratories were designed by Roscoe and Waterhouse, and many of us learnt our chemistry in them. The College became a University in 1880.

Roscoe's methods were largely modelled on those of Bunsen, and the Heidelberg tradition was transplanted to Manchester. In his day organic chemistry was taught at Heidelberg practically only to pharmacists, and Roscoe was relieved when he could hand this part of his course over to Schorlemmer. He continued as a teacher and investigator at Owens until his election as Member of Parliament for the Southern Division of Manchester in 1885, when he resigned. A year before this he had been knighted.

Besides his work on photochemistry we must say a word about Roscoe's investigations on vanadium. In 1865 he was asked to explain why the blue copper liquids from Alderley Edge could not be decolorized by metallic iron. He found that the residual blue colour was due to a compound of vanadium. Very little had been done with this element since Berzelius had worked on it and decided that vanadic acid was similar to sulphuric acid and had the formula VO_3. Roscoe found that it was really V_2O_5, like P_2O_5, that what Berzelius thought was the chloride was really $VOCl_3$, like $POCl_3$, and that the supposed metal was V_2O_2. The metal was first prepared by Roscoe. The isomorphism of the vanadates and phosphates discovered by Rammelsberg gave a valuable clue in this work. The beautiful specimens of Roscoe's vanadium compounds are still (or were in my time) exhibited in the lecture theatre at the College.

Roscoe's books are well known. The first was the "Lessons in Elementary Chemistry," the first edition of which appeared in 1866. This was translated into German, Russian, Italian, Hungarian, Polish, Swedish, Modern Greek, Japanese, and Urdu. The Urdu edition was lithographed and the page was twice the size of that in the English edition. By a process of homogeneous strain the illustration showing the length of a decimetre and its subdivisions was correspondingly magnified. His large work with Schorlemmer is still one of the most useful books on Inorganic Chemistry in the language.

Roscoe was not a great chemist, in the sense that Frankland was, nor was he as learned a man as Schorlemmer. But he was a great force and influence for the good in English chemistry and his name is one of which Manchester is proud. Inseparably connected with it is that of Carl Schorlemmer, to whom we now turn.

Carl Schorlemmer was born at Darmstadt in 1834. Although his parents were not wealthy he received a good education in mathematics and science at the Gewerbeschule, and we are told that he showed great skill in assisting in the laboratory. In 1852 he followed the example of his schoolfellow Dittmar and became a pharmacist. Whilst engaged in this profession he attended Bunsen's lectures at Heidelberg and there met Dittmar who had become Bunsen's assistant. In 1859 Schorlemmer gave up pharmacy and went to Giessen to learn chemistry from Will, who had succeeded Liebig. There he also heard Kopp lecture and no doubt acquired that interest in the history of chemistry which he retained throughout his life. His book "The Rise and Development of Organic Chemistry," which first appeared in 1879 and again, edited by his pupil Smithells in 1894, gave evidence of this, and Schorlemmer left at his death the MS. in German of a history of chemistry which he had brought to the end of the 17th century.

In 1859 Schorlemmer succeeded Dittmar as research assistant to Roscoe at Owens College, and by his assiduous attention to his academic duties he qualified himself for the first separate chair of organic chemistry in England, which he occupied from 1874 until his death in 1892.

Schorlemmer's work as a teacher is spoken of in the highest terms by his students. Smithells says that "although he had neither the graces of the orator nor the arts of the popularizer, his lectures were admirable in construction and suggestiveness." Although retiring in private life, and a bachelor who led a rather solitary existence, he was a good companion to his friends and had a very keen sense of humour. He retained his German characteristics and idiom to the end.

Of Schorlemmer's work we may first mention his collaboration with Roscoe in the great "Treatise," of which he wrote the organic portion, which is incomplete in the English edition although the work has been completed by Brühl and others in the German edition.

Smithells gives a bibliography of 60 memoirs and notes published by Schorlemmer. Of these many are on the paraffin hydrocarbons, of which he made a special study, some are on dyestuffs, a few are on inorganic chemistry, and one or two are of botanical interest.

Schorlemmer's most interesting work is probably that on the paraffins. He showed that Frankland's supposed isomers, methyl and ethyl hydride, were really the same: both were ethane, C_2H_6, and by annihilating a whole series of imaginary hydrocarbons and their derivatives, Schorlemmer simplified organic chemistry quite considerably. He worked on the hydrocarbons of petroleum and showed that they are mainly straight chain paraffins.

Schorlemmer in 1874 published a textbook called "The Chemistry of the Carbon Compounds or Organic Chemistry." Although he gives one definition of organic chemistry in the title, he gives another in the book, for he says that "organic chemistry is the chemistry of the hydrocarbons and their derivatives." Schorlemmer is quite logical in the definition of an organic chemical, for he says that "even the different kinds of cast iron . . . must be regarded as derivatives of hydrocarbons," and hence they are organic compounds.

THE CONSTITUTION OF ASCORBIC ACID*

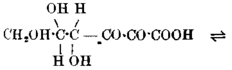
By PROF. W. N. HAWORTH, F.R.S.

Working in the biochemical laboratory at Cambridge Prof. Szent Györgyi isolated in 1928 a crystalline substance $C_6H_8O_6$ which he named hexuronic acid. Following the discovery of its antiscorbutic properties, and in view of the fact that the compound contains a molecule of water less than is required for hexuronic acid, the substance was re-named ascorbic acid. That it possesses antiscorbutic properties is abundantly clear and evidence has accumulated that it may prove to be the pure vitamin-C, but in view of experience in

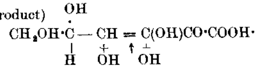
* Summary of a lecture delivered under the auspices of The Chemical Society at University College, Swansea, May 11, 1933.

this field it is necessary to observe caution before its claim to be regarded as the only antiscorbutic factor can be finally established. What has been made clear is that this substance has unique chemical as well as physiological properties. It is an oxidation derivative of a sugar, and the work which has been carried out in my laboratory by Dr. Hirst, Mr. Cox, and Dr. Reynolds (Nature, 1932, **130**, 888) has demonstrated that, following the oxidation with neutral iodine in water, further oxidation with sodium hypoiodite leads to cleavage and oxalic acid is formed quantitatively, along with a trihydroxybutyric acid which, since it oxidizes further to *d*-tartaric acid, is recognized as *l*-threonic acid. The initial oxidation with neutral iodine in water was first observed by Szent Györgyi and interpreted as due to the removal of two hydrogen atoms from the molecule. The initial oxidation is a reversible process since evaporation in contact with the hydriodic acid which is formed in this procedure, or reduction with sulphuretted hydrogen, regenerates the ascorbic acid. It is probably this feature of reversible oxidation and reduction which gives to ascorbic acid its biological activity. Dr. Hirst has shown *that ascorbic acid yields readily a diphenylhydrazone* as well as other derivatives of the same type with bromophenylhydrazine and dinitrophenylhydrazine.

In "Nature" of December, 1932 (page 888), Hirst, Cox, and Reynolds first showed that the break-down of ascorbic acid on oxidation requires the formulation of the reversible oxidation product as a 2 : 3-diketohexonic acid (I). At that time it was thought that the reversible oxidation process should be interpreted as the introduction of one oxygen rather than the removal of two hydrogen atoms, and therefore the following formula (II) for ascorbic acid was proposed:

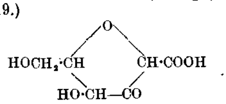


(I) (first oxidation product)



(II)

An alternative formula had first occurred to us, namely, the hydrofurane compound of the structure (III) given below, which has in the interval been suggested by Micheel and Kraft (Zeit. physiol. Chemie, 1933, **215**, 219.)

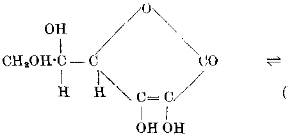


(III)

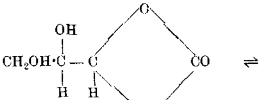
After mature consideration this formula (III) was not advanced by us because it failed to account for several of the chemical properties, and was totally at variance with the crystallographic data as determined in my laboratory by Cox (Nature, August 6, 1932, page 205).

The absorption spectrum of ascorbic acid was examined quantitatively by Herbert and Hirst (Nature, 1932, August 6, page 205). From the above and other more extended observations it was shown that in methyl alcohol and in aqueous solution (20 mg. per litre) an intense band is found at 260—265 mμ. In ethyl alcohol and also in acidified aqueous solutions the band occurs at 245 mμ. Salts of ascorbic acid have the band at 265 mμ, whilst in the case of the dimethyl derivative it has moved to 230 mμ (contrast Micheel and Kraft, Zeit. physiol. Chemie, 1933, **216**, 233). Deviations from Beer's law occur, but in very dilute solution the law is followed with sufficient exactness for quantitative estimates of concentration to be made spectrophotometrically. The freshly prepared first oxidation product of ascorbic acid does not display selective absorption in this region. An extremely close resemblance is found between the absorption phenomena of ascorbic acid and those of dihydroxymaleic acid. The substances show great similarity chemically and it would appear highly probable that the same type of structure =C — C(OH) = C(OH) — is present in both.

It became clear as further work proceeded in the Birmingham laboratories that the constitution of ascorbic acid could best be expressed by its formulation as (IV) which is capable *inter alia* of passing by enolization into (V),

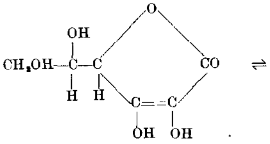


(V)

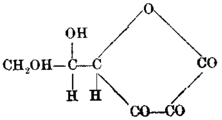


(IV)

and these new formulæ were proposed in a paper published in CHEMISTRY AND INDUSTRY (March 10, 1933, pp. 221—222) by Dr. Hirst and his co-workers. Evidence was adduced that the reversible oxidation product previously formulated as (I) should, by reason of its properties when freshly prepared, be represented as the lactone (VI), rather than as the free acid (I). The relationship between ascorbic acid and its reversible oxidation product could then be expressed:

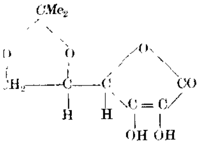


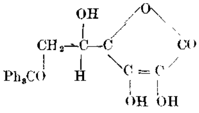
(V)



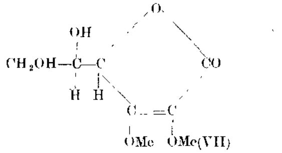
(VI)

*This formula permits of the representation of the acetone compound, and the trityl derivative (Vargha, Nature, 1932, **130**, 847; Biochem. Zeit., 1933, **258**, 4) as follows:*

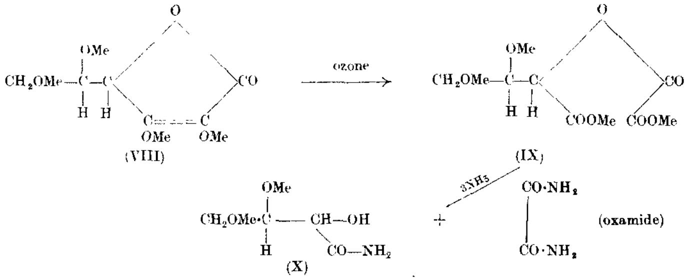




Ascorbic acid gives a di-, tri-, and tetra-methyl lerivative. The dimethyl derivative is produced by he action of diazo-methane on the acid (Karrer, Helv. him. acta, 1932, **16**, 181), and Hirst, Percival, and Smith have shown that this has a double linking at position 2 : 3 of the C_6 chain (formula VII) since, as will pe seen below, two oxygen atoms are introduced by ozone and a neutral dibasic ester is formed.

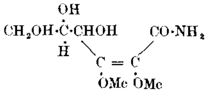


Working with the tetramethyl drivative (VIII) Hirst, Percival, and Smith (Nature, 1933, **131**, 617) nowed that the ozonized product, the dibasic ester, nust have the constitution (IX) since it breaks down with ammonia to give oxamide quantitatively and also good yield of 3 : 4-dimethyl *l*-threonamide (X) accomanied by the stereoisomeric form 2 : 3-dimethyl erythronamide.



ie exposed hydroxyl group in this latter degradation oduct (X) is definitely at position 2 in the C_4 chain, *i.e.*, e substance is an α-hydroxy-acid derivative. This was proved by its breakdown in contact with sodium hypochlorite to give sodium isocyanate in excellent yield. The position of this exposed hydroxyl group in this dimethyl *l*-threonic acid derivative furnishes evidence of the position of the oxygen link responsible for ring formation, whilst the formation of oxalic acid affords proof of the ester linking with this exposed hydroxyl group and number 1 carbon atom. The ring is therefore a 1 : 4-ring, similar to that in a furanose sugar or a γ-lactone. The alternative of a 2 : 4-ring, which is not excluded by the evidence from the cleavage products, is nevertheless rendered invalid by the following facts:

The dimethyl ascorbic acid combines, additively, but without loss of methoxy groups, with ammonia in methyl alcohol and forms a crystalline product (XI), and this is recognized as the acid amide of dimethyl ascorbic acid. It behaves exactly as an acid amide towards chemical reagents, and moreover with alkali the whole of the ammonia is evolved quantitatively. Again, the sodium salt of dimethyl ascorbic acid is formed without loss of a methyl residue, and furthermore the reversible oxidation product of ascorbic acid behaves as a lactone and not as a free acid.



(XI)

This is the best possible evidence that ascorbic acid in passing into the dimethyl derivative with diazomethane is reacting as the 2 : 3-di-enol (V). The acidity of ascorbic acid must, therefore, be due to the enolic group at either carbon atom 2 or 3, and the sodium and calcium derivatives which have been prepared must be represented as derivatives of this particular formulation.

The lactone ring is not opened by this salt formation, and in this respect there is some analogy with another interesting compound of the sugar group which we have been investigating simultaneously, namely, the di-lactone of mannosaccharic acid. This substance in alkaline solution reduces Fehling's solution actively. It shows an absorption band, and without opening of the lactone ring can combine with alkalis or with diazomethane to give the dimethyl derivative. There can be no doubt that the exceptional properties of this substance are due to enolization between carbon atoms 1 and 2. On the

ther hand the ordinary di-potassium salt of manno-accharic acid, prepared expressly by the opening of the ictone ring, does not reduce Fehling's solution, nor does possess the distinctive properties of the enolized ompound. Similarly dihydroxymaleic acid has many roperties in common with ascorbic acid. It is oxidized v neutral iodine in water to dihydroxytartaric acid, nd is readily methylated with diazomethane. The quence of changes can be formulated as below.

$$\begin{matrix} HO\cdot C\cdot COOH \\ \| \\ HO\cdot C\cdot COOH \end{matrix} \rightarrow \begin{matrix} (HO)_2C—COOH \\ | \\ (HO)_2C—COOH \end{matrix} \rightarrow \begin{matrix} OC—COOH \\ | \\ OC—COOH \end{matrix}$$

All these facts go to disprove the formulation which supported by Micheel and Kraft (*loc. cit.*) and by eichstein, Grüssner and Oppenauer (Helv. Chim. cta, 1933, **16**, 561) who represent ascorbic acid as the ydrofurane derivative (III) identical with the formula e had discarded. A substance with this constitution ould pass with considerable ease to a furane carboxylic cid derivative, whilst the spatial model of such a onstitution would not fit into the crystallographic ell.

We have been engaged for several months on synthetic ork leading to the isolation of the *d*- and *l*-forms of scorbic acid and related substances. One of the hemes under investigation involves the addition of HCN to *l*-xylosone (A), hydrolysis of the resulting vanhydrin (B) and lactonization of the acid (C). It hould be mentioned in passing that xylosone had not itherto been prepared and that full investigation of s properties and of the reaction mechanism during he various intermediate stages are necessary prelimi-aries to any claim of structural proof derived from a vnthesis. The final product would be expected to ave structure (IV) which, according to evidence resented from the Birmingham laboratories, is that f natural *l*-ascorbic acid (Hirst, J.S.C.I., 1933, **52**, 21; Hirst, Percival, and Smith, *loc. cit.*); tautomeric odifications of IV are of course possible.

$$CH_2OH\cdot(CHOH)_2\cdot CO\cdot CHO \text{ (A)} \xrightarrow{HCN}$$
$$CH_2OH\cdot(CHOH)_2\cdot CO\cdot CHOH\cdot CN \text{ (B)} \longrightarrow$$
$$CH_2OH\cdot(CHOH)_2\cdot CO\cdot CHOH\cdot COOH \text{ (C)} \longrightarrow$$
$$CH_2OH\cdot CHOH\cdot \overset{\lceil\text{———}O\text{———}\rceil}{CH\cdot CO\cdot CHOH\cdot CO} \quad \text{(IV)}$$

In the meantime, Reichstein (*loc. cit.*) has claimed a nthesis of *d*-ascorbic acid based on a similar series of actions. This author obtained a strongly reducing roduct from " crude xylosone " by the action of HCN, llowed by hydrolysis. No ascorbic acid was isolated ut a small quantity of an acetone derivative was btained which resembled in m.p. and reducing power e acetone derivative of ascorbic acid. No specific tation was quoted and the analytical data were faulty. till more serious, however, are the facts that Reichstein ssumes, entirely without evidence, a particular furanose ructure (D) for xylosone, and maintains that the urse of the reactions is that shown below. He claims at these results support Micheel's formula (III) for orbic acid.

$$\text{(D)}\ CH_2OH\cdot \overset{\lceil\text{——}O\text{——}\rceil}{CH\cdot CHOH\cdot CO\cdot CHOH} \xrightarrow{HCN}$$
$$CH_2OH\cdot \overset{\lceil\text{——}O\text{——}\rceil}{CH\cdot CHOH\cdot CO\cdot CH}\cdot CN \longrightarrow$$
$$CH_2OH\cdot \overset{\lceil\text{——}O\text{——}\rceil}{CH\cdot CHOH\cdot CO\cdot CH}\cdot COOH \quad \text{(III)}$$

To those familiar with carbohydrate chemistry, the mechanism assigned by Reichstein to the reaction between xylosone and HCN is unacceptable, as it is clear that even if we assume a ring formation for the osone this will open out at once to the chain form (B) by union with hydrocyanic acid. The type of formulation chosen by Reichstein cannot be accepted as evidence of his structure. The position is, therefore, that in the event of Reichstein's compound being found, as the result of further work, to be identical with the optical enantiomorph of acetone-ascorbic acid, the isolation of this substance is to be taken as strong evidence in support of the structure (IV) which we have advanced for ascorbic acid, the course of the reactions being the normal one indicated as A ⟶ B ⟶ C ⟶ (IV).

INDUSTRIAL DEVELOPMENT IN PALESTINE

Political troubles in other parts of the world have undoubtedly had an effect on the development of Palestine as a National Home for the Jews. There is more money in the country already than can be used immediately by the banks in ordinary commercial enterprise, and much of it remains on deposit until some safe and profitable outlet arises for it.

Several industries have been established already, such as cement, bricks, and tiles for building. Soap-making and extraction of edible oil and oil refining was soon started or expanded, and the extraction of chemicals from the Dead Sea has proved a great success. Regular shipments of potash from the Dead Sea to the United States have been planned, and it is anticipated that in 1933, when the equipment has been completed, the annual output will be in the neighbourhood of 10,000 tons. An industry for which the raw materials are not available locally, but which has been established successfully, is the making of cardboard containers. There is a large local demand for the products. Another industry which had to import all its raw materials is the making of artificial teeth. The porcelain was brought from Canada, and a steadily rising export trade has been developed. The factory began its work in 1926 and in 1927 its output was valued at £1100; in 1932 the production was valued at no less than £20,000.

There are many such industries now in full swing in Palestine, among which may be mentioned bedsteads, biscuits, preserved fruits, custard powder, leather, fruit juice, aerated waters, boot-polish, glue, candles, scouring powders, poultry feed, tooth paste, shaving soap, and aluminium ware. There is a gap of about £5,000,000 between imports and exports in Palestine, and the growth of new industries such as those which have been enumerated is helping to lessen this gap.

Palestine has a large consuming population, and the demands grow year by year. The demand exists, and so does the capital. It only remains to supply the knowledge and skill, and that is being done by degrees —more quickly perhaps than was expected, on account of the political situation in certain parts of the world.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

Food Group. Members are reminded that if they wish to take advantage of the special travel facilities in connexion with the Royal Sanitary Institute Congress on June 17—24, they must apply for them as early as possible to Dr. Dudley Robinson at the Royal Sanitary Institute, Buckingham Palace Road, S.W.1. Dr. Robinson is also prepared to consider applications from members for participation in other activities of the Congress. The Group's Session commences at 10 a.m. on Wednesday, June 21, in the Spanish Hall, Winter Gardens, Blackpool (see Calendar of Forthcoming Events), and the blue tickets already issued must be presented for admission.

Annual Meeting, Newcastle, July 10—14.—Programmes and application forms have been sent to every member by post. If any copy has miscarried it can be replaced on application to the General Secretary. The application should be filled up as early as possible and forwarded to Mr. Craggs in Newcastle.

AMERICAN SECTION

The American Section of the Society has elected the following officers for 1933—34:—*Chairman*, A. E. Marshall; *Treasurer*, J. W. H. Randall; *Secretary*, Foster D. Snell; *Committee*, Messrs. Allen Rogers, G. J. Esselen, D. D. Jackson, W. D. Turner, R. J. Moore, Gustav Egloff, Irving Hochstadter, J. G. Detwiler, A. W. Hixson, Floyd Metzger, W. W. Winship, O. P. Amend, Harlan S. Miner, and F. A. Lidbury.

The Section and other participating societies were addressed by Dr. Gustav Egloff on May 12 at a joint meeting held at the Chemists' Club, 52, East 41st Street, New York City. The address was entitled "Synthetic Petroleum Products" and dealt with the contributions chemical research had made to the refining of crude oil in the last few years.

Forty years ago, before the day of the automobile, refining was merely a matter of separating the various constituents of crude oil and selling them. Kerosene was the important product and gasoline was a waste. With the advent of the motor car and the simultaneous development of gas and electricity the situation was reversed, gasoline becoming of chief importance. Further developments in the automotive industry in recent years, as well as in the airplane, electrical, machine, power plant, road building, solvent, and alcohol industries, had been accompanied by intensive research in the oil industry, not only to conserve crude oil, but to produce new products, cut the costs of present ones and develop new methods of refining.

Although there had been predictions of an eventual oil shortage, Dr. Egloff stated that there was evidence at present of a supply sufficient to last for at least a century whilst the number or extent of oil pools yet to be discovered could be estimated. In addition, in the last twenty years chemists had shown how to increase the yield of gasoline from crude oil more than 300%, and in addition greatly to improve its quality. By the use of the cracking process it was estim that over 3,000,000,000 barrels of crude oil had t conserved in the last 6 years alone.

The speeds which automobiles, airplanes, and mo boats had attained had thrown a heavy burden on oil industry to provide adequate lubricants. M progress has been made in the manufacture of lubricat oils in the last few years than in the preceding thi New extreme-pressure lubricants had been develo made up of blends of petroleum oils, saponifiable c and sulphur. Crude oils for lubricants were carefi selected and improvements in the refining process been made for this particular demand. Synth lubricating oils had been developed by hydrogenat Polymerization by aluminium chloride of oil produ by cracking also yielded lubricants.

The oil industry could produce over 1,000,000, gallons of alcohol a year from cracked gases. At present time over 4,000,000 gallons of ethyl alcohol w being produced yearly from this source, at a p competitive with alcohol produced from grain molasses. If the economic situation demanded it, oil industry could supply the United States with alcoh Enormous volumes of oil were available which cc be cracked into unsaturated hydrocarbons and c verted into alcohols in direct competition with alco from agricultural products. Other synthetic prod from the petroleum industry included such mater as asphalt, road oils, fuel oils, solvents, and resins.

BRITISH ASSOCIATION OF CHEMISTS

The annual meeting of the Birmingham Section of British Association of Chemists was held at the room the Birmingham Chamber of Commerce, New Str on May 30 with Mr. J. R. Johnson, chairman, presid Prof. E. C. C. Baly, F.R.S., president of the Associat attended to address the meeting on the work of Association and there was a very good attendance members.

The chairman reviewed the events of the year pointed out that every phase of the Association's w was progressing. The number of appointments d with by the appointments bureau had increased by c 50%. The unemployment benefit fund had paid £8500 in benefit, and the right of the chemist t minimum of three months' notice had now been fir established.

In his annual report the secretary stated that Section continued to make progress in the numbe members and as in previous years co-operation between Section and the local Sections of the Institute of Ch istry and the Society of Chemical Industry had b demonstrated in the joint social functions of the Midl Chemists' Dinner and the Joint Concert, both of wl were well attended and very successful.

The officers elected for the ensuing year we *Chairman*, Mr. J. R. Johnson; *Vice-Chairman*, A. W. Knapp; *Hon. Treasurer*, Mr. W. Salmon; *Sec Recorder*, Mr. H. W. Rowell; *Hon. Secretary*, R. A. V. Tayar; *Membership Secretary*, Mr. A. Chu man.

CORRESPONDENCE

QUALITATIVE TESTS TO DISTINGUISH BETWEEN OXYCELLULOSE AND HYDROCELLULOSE

SIR,—In a recent paper by H. A. Thomas (this JOURNAL, March 31, 1933, p. 85 T) a "Turnbull's blue" test for distinguishing oxycellulose from hydrocellulose is described which in many ways offers advantages over other tests.

However, I am surprised to learn that Thomas finds "the 'heat test' described by M. Fort difficult to apply . . . it was fonnd that the hydrocellulose material became discoloured to the same extent as the oxycellulose." ("A Heat Test Applied to Tendered Cotton and Linen Fabrics," M. Fort, Journ. Soc. Dyers and Col., 1932, **48**, 94.)

Samples of oxycellulose material and hydrocellulose material prepared from bleached cotton sheeting by air-drying after immersion in alkaline hypochlorite and 5% sulphuric acid, as described by Thomas, subjected to the heat test after preparation as described by me, show the oxycellulose material to turn an intense brown while the original material and hydrocellulose material remain still white. If the hypochlorite tendering be restricted to a barely perceptible weakening and the acid-tendering made severely weakening, the distinction is still very sharp and the test easy. Exactly how Thomas failed to get these results, whether by over-heating, inadequate purification, etc., I cannot say, but the need of sympathetic precautions in these tests is illustrated by the complete failure of the "Turnbull's blue" test to provide any distinction whatever when first tried by me with materials prepared exactly as described by Thomas. However, on slightly acidifying the ferricyanide solution, all became satisfactory, and the results were as claimed.

I am, Sir, etc.,
M. FORT

Almondbank,
Perthshire
May 30, 1933

PERSONAL AND OTHER ITEMS

The University of London has awarded the degree of Ph.D. (biochemistry) to Mr. J. T. Martin, of the Rothamsted Experimental Station, and the Ph.D. (chemistry) degree to Mr. W. H. Banks and Mr. E. R. Parken.

Sir Alfred Ewing, F.R.S., the distinguished scientist, has been presented with the freedom of Dundee, the city in which he was born in 1855.

The Chemists' Club, of New York, has elected Dr. Lewis H. Marks as president. Dr. Marks is the executive secretary of the Industrial Alcohol Institute and has been a member of the Society for a number of years.

The Science Scholarships Commerce of the Royal Commission for the Exhibition of 1851, on the recommendation of the University of Edinburgh, has appointed Dr. Harry W. Melville to a senior studentship for research in physical chemistry, and on the recommendation of the University of Oxford has appointed Dr. B. K. Blount to a senior studentship for research in organic chemistry.

Dr. J. M. Thomson, who died recently, left unsettled estate of £6521, with net personalty £460.

Birthday Honours

Among the honours conferred by the King on the occasion of his 68th birthday are the following:

Knights: Dr. J. C. Clayton, President of the Institute of Chemistry, and a director of Imperial Chemical Industries, Ltd.; Dr. M. O. Forster, F.R.S., until recently Director of the Indian Institute of Science, Bangalore, India; Mr. R. S. Pearson, Director of the Forest Products Research Laboratory, D.S.I.R.: Mr. N. B. Saklatvala, chairman of Tata Sons, Ltd., Bombay; Mr. P. W. L. Ashley, Secretary, Import Duties Advisory Committee. *K.C.M.G.:* Sir James Currie, K.B.E., chairman of the Governing Body, Imperial College of Tropical Agriculture, and director of the Empire Cotton Growing Corporation. *C.B.:* Dr. A. L. Thomson, assistant secretary, Medical Research Council. *C.B.E.:* Mr. V. E. Pullin, Director of Radiological Research, Royal Arsenal, Woolwich. *O.B.E.:* Mr. R. A. Thomas, chairman of the Metalliferous Mining Advisory Committee, Mines Department of the Board of Trade.

Lead

In view of the widespread importance of the lead industry, the revised edition of "Lead" (4s.), just issued by the Imperial Institute in its comprehensive series on the Mineral Resources of the British Empire and Foreign Countries, will be welcomed. The British Empire supplies 26% of the world's production of lead, and three Empire countries are amongst the leading producers, Australia being third, Canada fourth, and Burma seventh. Since the issue of the first edition of this volume, important new deposits of the metal have been located and its uses still further extended; consequently the document, which has been entirely rewritten, has grown from 95 to 253 pp.

The bulk of the book (183 pp.) consists of a summary of information concerning the occurrence, geology, and mining of lead ores; and no country, British or foreign, in which occur lead deposits of present or potential economic interest, is neglected. An account is included of the concentration and metallurgy of lead ores, and the numerous industrial uses for the metal, its alloys and compounds.

The section devoted to the metallurgy of lead includes an account of the latest improvements in the refinery at Port Pirie, South Australia. This plant is unique in that the process is continuous, a steady stream of metal continuing through all stages until the market lead flows into the mould of the casting wheel.

The section devoted to uses (17 pp.), briefly describes modern development in regard to lead alloys and pigments, and tables are given summarizing the composition of lead-base bearing alloys, type metals or printers' alloys, soft solders, fusible alloys, bronzes, and regulus metal. Methods for the manufacture of lead pigments are also briefly described.

Manchester Literary and Philosophical Society

During June, July, and August, the house of the Manchester Literary and Philosophical Society will be closed at 6 p.m. on Tuesdays, Wednesdays, and Fridays, and at 9 p.m. on Mondays and Thursdays.

Evening Classes in Manchester

From June 12 to July 29 the Manchester Municipal College of Technology is holding a number of evening classes in subjects connected with chemical technology, textile chemistry, textile industries, photographic technology, mining, building, and engineering. The courses cover a wide range of useful subjects, *e.g.*, industrial fermentation processes, tar testing, paper testing, mercerization, cloth analysis, etc., and the fees for the courses are small.

The Paint and Varnish Society

The *Journal of the Oil and Colour Chemists' Association* states that it proposes shortly to publish a history of the Paint and Varnish Society.

Japanese Chemical Industry

Official figures quoted in *Die Chemische Industrie* (Apr. 22, 1933) show that at the end of 1930 there were 3329 chemical firms iu Japan, employing 142,970 people. About 700 of these firms were connected with the rubber and celluloid industries. The production of sulphur in 1932 was 77,085 t., compared with 55,235 t. in 1931. The production of potassium chlorate in Japan commenced in 1932, and has resulted in a rapid decrease in the quantity imported. A rapid expansion has also taken place in the photographic industry. Production in 1929 was valued at 3·7 million yen, and in 1931 at 8 million yen. Roughly half of the country's present requirements are satisfied by the home industry. Films in particular are cheaper, but are said to be inferior in quality to those imported.

Coconut Research Scheme in Ceylon

The formal opening of the laboratories of the Coconut Research Scheme at Bandirippuwa Estate in Ceylon marks an important stage in the application of scientific knowledge to the development of one of the Island's principal industries. The Institute is intended to assist both the planting industry and the manufacturing industries connected with the products derived from the palm. The commercial uses of coconut products are capable of further extension and the work of the Institute will have wide scope to increase in number and improve in quality the various by-products of the industry.

Smoke Abatement

Representatives of a number of local authorities in Northumberland and Durham recently appointed an Advisory Smoke Abatement Committee for the area, of which Dr. J. A. Charles, Medical Officer of Health for Newcastle, consented to accept the position of honorary secretary. The representatives were addressed by Mr. A. Marsh, of the National Smoke Abatement Society, and Dr. J. T. Dunn, president-elect of this Society, and it was agreed that the committee should undertake to consider the general question of smoke pollution. Figures were quoted at the meeting to show that in the years 1929—32 the number of hours of sunshine in Newcastle was nearly 16% less than at Cockle Park.

A Correction

In reviewing the Dizionario di Chimica the authors' names were incorrectly given; they are Prof. Michele Giua and Dr. Clara Giua-Lollini.

COMPANY NEWS

BOOTS PURE DRUG CO., LTD.

The accounts of the company for the year ende March 31 confirm the preliminary statement (cf. CHEM & IND., May 12) showing a net profit of £701,453 The general reserve of the company has been raised t £1,400,000. During the year a large part of the manu facturing business has been transferred to the nev works at Beeston.

W. J. BUSH & CO.

The net profit of the company for 1932 was £58,970 as compared with £30,313 in the previous year. A fina ordinary dividend of 6% is to be paid, bringing th total for the year to 9%, which is an increase of 2½% compared with the previous year. The amount carrie forward is increased by £29,638 to £111,512. Ampl provision is made for any loss sustained in the recen explosion at the Mitcham works.

THE BLEACHERS' ASSOCIATION

The accounts of the Bleachers' Association, of Man chester, for the year ended March 31, 1933, show trading profit of £385,203, as compared with £390,58 last year. After provision for depreciation etc. an with £212,999 brought in, the balance available fo dividends is £320,172. Preference dividend absorb £136,812, and no ordinary distribution is to be made as was the case last year.

CHEMICAL AND METALLURGICAL CORPORATION

In a circular letter to shareholders it is stated tha the Board is in negotiation with a substantial concern and it is anticipated that an offer will be made to acquir the whole of the issued share capital of the corporation In these circumstances the directors advise the share holders, in their own interests, not to part with thei holdings pending receipt of a further statement from th Board.

ZINC CORPORATION

The directors of the corporation have announce a dividend of 5% on the ordinary shares for 1932, an a participating dividend of 2½% on the preferenc shares, both less tax. The annual report and genera meeting are to be deferred until the return of th managing director from Australia.

YORKSHIRE DYEWARE AND CHEMICAL CO., LTD.

The net profit of the company for the year ende March 31, 1933, was £19,905, representing a sligh increase as compared with last year. A final dividen of 7½% has been recommended, making a total for th year of 10%, the same as last year.

INTERNATIONAL NICKEL CO.

The International Nickel Co. of Canada sustained a net loss of $80,158 during the first three months of 193 as compared with a net profit of $536,072 in the firs quarter of 1932. Compared with this period last year the net operating income fell from $1,425,834 to $824,406 During the quarter the earned surplus was credited wit $137,000, representing a credit in respect of taxes in prior years. After payment of preferred dividend th earned surplus stands at $14,261,927.

MARKET REPORT

This Market Report is compiled from special information received from the manufacturers concerned.

Unless otherwise stated, the prices quoted below cover fair quantities net and naked at sellers' works.

GENERAL HEAVY CHEMICALS

Acid, Acetic, 40% tech.—£20 5s. per ton d/d address U.K. in casks.

Acid, Chromic.—11d. per lb., less 2½% d/d U.K.

Acid, Hydrochloric.—Spot, 3s. 9d.—6s. per carboy d/d according to purity, strength, and locality.

Acid, Nitric 80° Tw.—Spot, £18—£25 per ton makers' works, according to district and quality.

Acid, Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.

Ammonia (Anhydrous).—Spot, 10d. per lb. d/d in cylinders.

Ammonium Bichromate.—8d. per lb., d/d U.K.

Bisulphite of Lime.—£6 10s. per ton. f.o.r. London, packages free.

Bleaching Powder, 35/37%.—Spot, £8 15s. per ton d/d station in casks, special terms for contracts.

Borax, *Commercial.—Granulated*, £15 10s. per ton; Powder, £17 per ton. (For 1-ton lots and upwards, packed in 1-cwt. bags, carriage paid any station in Great Britain.)

Calcium Chloride, Solid, 70/75%.—Spot, £5 5s. per ton d/d station in drums.

Chrometan.—Crystals, 3½d. per lb.; Liquor, £19 10s. per ton d/d U.K.

Chromium Oxide.—10d.—10½d. per lb., according to quantity, d/d U.K.

Methylated Spirits, 61 O.P.—Industrial, 1s. 8d.—2s. 3d. per gal.; Pyridinized Industrial, 1s. 10d.—2s. 5d. per gal.; Mineralized, 2s. 9d.—3s. 3d. per gal. 64 O.P. 1d. extra in all cases. Prices according to quantity.

Nickel Sulphate.—£49 per ton d/d.

Nickel Ammon. Sulphate.—£49 per ton d/d.

Potash, Caustic.—£30—£33 per ton. Potass. Bichromate crystals and granular.—5d. per lb., net d/d U.K., for spot. Discount according to quantity. Ground, 5⅝d. per lb.

Potassium Chromate.—6½d. per lb., d/d U.K.

Sal ammoniac, Firsts lump.—Spot, £42 17s. 6d. per ton d/d address in barrels. Chloride of Ammonia.—£37—£45 per ton, carr. paid.

Salt Cake, unground.—Spot, £3 15s. per ton d/d station in bulk.

Soda Ash, 58° E.—Spot, £5 17s. 6d. per ton, f.o.r. in bags, special terms for contracts.

Soda, Caustic, solid 76/77° E.—Spot, £14 5s. per ton d/d station in drums, special terms for contracts.

Soda crystals.—Spot, £5—£5 5s. per ton d/d station or ex depôt in 2-cwt. bags.

Sod. Acetate 97/98%.—£21 per ton. Sod. Bicarbonate (refined).—Spot, £10 10s. per ton d/d station in bags. Sod. Bichromate Crystals, Cake, and Powder.—4d. per lb., net d/d U.K., discount according to quantity. Anhydrous 5d. per lb. Sod. Bisulphite Powder 60/62%.—£16 10s. per ton delivered, 1-cwt. iron drums for home trade.

Sodium Chromate.—3¾d. per lb., d/d U.K.

Sod. Phosphate.—£12 10s. per ton, f.o.r. London, casks free. Sod. Silicate 140° Tw.—Spot, £8 5s. per ton d/d station, returnable drums. Sod. Sulphate (Glauber's Salt).—Spot, £4 2s. 6d. per ton d/d. Sod. Sulphide solid, 60/62%.—Spot, £10 15s. per ton, d/d in drums. Crystals, 30/32%.—Spot, £8 per ton, d/d in casks. Sod. Sulphite, Pea Cryst.—Spot, £13 10s. per ton, d/d station in kegs; Commercial.—Spot, £9 10s. per ton, d/d station in bags.

RUBBER CHEMICALS

Antimony Sulphide.—Golden.—6½d.—1s. 1¼d. per lb., according to quality. Crimson.—1s. 3d.—1s. 5d. per lb., according to quality.

Arsenic Sulphide, Yellow.—1s. 5d.—1s. 7d. per lb.

Barytes.—£7 10s.—£9 per ton, according to quality.

Cadmium Sulphide.—3s.—3s. 4d. per lb.

Carbon Bisulphide.—£30—£32 per ton, according to quantity, drums extra.

Carbon Black.—3⅝d.—5¼d. per lb., ex wharf.

Carbon Tetrachloride.—£41—£46 per ton, according to *quantity, drums extra.*

Chromium Oxide, Green.—1s. 2d. per lb.

Diphenylguanidine.—2s. 2d. per lb.

India-rubber Substitutes, White.—4¼d.—4¾d. per lb. Dark.—3¼d.—4¼d. per lb.

Lamp Black.—£45—£48 per ton.

Lead Hyposulphite.—9d. per lb.

Lithopone, 30%.—£17 10s.—£18 per ton.

Mineral Rubber "Rupron."—£18 10s. per ton.

Piperidine Rubber Accelerators.—P.P.D.—10s. 6d.—11s. 6d. per lb.; Z.P.D.—7s.—7s. 6d. per lb.; L.P.D.—6s. 6d.—7s. per lb.; P.T.D.—9s. 8d.—10s. 4d. per lb.; C.P.D.—8s. 3d.—8s. 10d. per lb.; S.P.D.—8s. 1d.—8s. 7d. per lb.; P.T.M.—11s. 6d.—12s. 6d. per lb.

Sulphur.—£11 15s. per ton. Sulphur Precip. B.P.—£55—£60 per ton. Sulphur Precip. Comm.—£50—£55 per ton.

Sulphur Chloride.—5d.—7d. per lb., according to quantity.

Vermilion, pale or deep.—4s. 1d.—4s. 6d. per lb.

Zinc Sulphide.—11d.—1s. per lb., according to quality.

WOOD DISTILLATION PRODUCTS

Acetate of Lime.—Brown, £8 10s.—£8 15s. per ton. Grey, £13—£14 per ton. Liquor, Brown, 30° Tw., 6d. per gal.

Amyl Acetate, technical.—95s.—110s. per cwt.

Charcoal.—£6—£11 per ton, according to grade and locality.

Methyl Acetone, 40/50%.—£50—£52 per ton.

Wood Naphtha. — Miscible.—2s. 7d.—4s. per gal. Solvent, 3s. 9d.—4s. 9d. per gal.

Wood Tar.—£2—£6 per ton.

Wood Creosote.—6d.—2s. per gal.

TAR PRODUCTS

Acid Carbolic.—Crystals.—9d.—10d. per lb. Crude 60's, 2s. 5d.—2s. 6d. per gal. 2% water—3s. 0¾d. per gal.

Acid Cresylic, 99/100.—11d.—1s. 8d. per gal., according to specification. Refined, 1s. 7d.—1s. 8d. per gal. Pale, 98%, 1s. 2d.—1s. 3d. per gal. 95%, 11d.—11½d. per gal. Dark, 10d. per gal.

Anthracene Oil, Strained, 4½d. per gal.

Benzole.—Prices at works: Crude, 9d.—9½d. per gal.; Standard motor, 1s. 4d.—1s. 4½d. per gal.; 90%, 1s. 5d.—1s. 6d. per gal.; Pure, 1s. 7½d.—1s. 8d. per gal.

Creosote.—B.S.I. specification, 3d. per gal., d/d. Heavy—4d. per gal.

Naphtha.—Solvent, 90/160, 1s. 4d.—1s. 5d. per gal. Solvent 95/160, 1s. 7d. per gal. Solvent 90/190, 9d.—1s. 1d. per gal.

Naphthalene.—Purified crystals, £9 10s. per ton in bags. Crude, Hot Pressed, £6 5s. per ton. Flaked,

Pitch, medium, soft.—85s. per ton, in bulk at makers' works.

Pyridine.—90/140—3s. 9d.—4s. 6d. per gal.; 90/180—2s.—2s. 3d. per gal.

Toluole.—90%, 2s.—2s. 1d. per gal. Pure, 2s. 4d. per gal.

Xylol.—1s. 10d.—1s. 11d. per gal. Pure, 2s. 1d.—2s. 2d.

PHARMACEUTICAL AND PHOTOGRAPHIC MATERIALS

Acid, Acetic, Pure 80%.—£39 5s. per ton d/d address U.K. in casks.

Acid, Acetyl Salicylic.—2s. 9d.—2s. 11d. per lb., according to quantity.

Acid, Benzoic, B.P.—1s. 9d.—1s. 11d. per lb. Solely ex Gum.—1s. 3d.—1s. 6d. per oz.; 50-oz. lots, 1s. 3d. per oz.

Acid, Boric, B.P.—*Cryst., £35 10s. per ton.* Powder, £36 10s. per ton. Ex-Fine Powder, £38 10s. per ton. *For 1-ton lots and upwards, packed in 1-cwt.* bags, carriage paid any station in Great Britain.

Acid, Camphoric.—19s.—21s. per lb.

Acid, Citric.—9¼d. per lb. Less 5%.

Acid, Gallic.—2s. 9d. per lb. for pure crystal in 1-cwt. lots.

Acid, Molybdic.—5s. 3d.—5s. 9d. per lb., according to quantity.

Acid, Pyrogallic. Cryst.—6s. 9d. per lb. for 1-cwt. lots. *Resublimed.—8s. 6d. per lb. for 28-lb. lots d/d.*

Acid, Salicylic.—B.P. pulv., 1s. 7d.—1s. 10d. per lb. Technical, 1s. 2d.—1s. 4d. per lb.

Acid, Tannic, B.P.—3s. 9d. per lb.

Acid, Tartaric.—11¾d. per lb. Less 5%.

Acetanilide.—1s. 5d. per lb.

Ammon. Benzoate.—3s. 3d.—3s. 9d. per lb.

Ammonium Hippurate.—19s. 6d.—23s. 6d. per lb.

Ammonium Iodide.—17s.—17s. 6d. per lb.

Ammonium Molybdate.—5s.—5s. 6d. per lb., according to quantity.

Argent. Nitras, Crystal.—1s. 1d. per oz.

Arsenic Iodide.—22s. 6d.—25s. per lb.

Benzonaphthol.—3s. 3d.—3s. 9d. per lb.

Berberine, Hydrochloride.—5s. 6d.—6s. per oz.; Sulphate, 5s. 6d.—6s. per oz.

Bismuth Salts.—Carbonate, 6s. 10d. per lb.; Citrate, 9s. 3d. per lb.; Nitrate (cryst.), 4s. 7d. per lb.; Oxide, 10s. 6d. per lb.; Salicylate, 7s. 7d. per lb.; Subchloride, 10s. 3d. per lb.; Subgallate, 7s. 3d. per lb.; Subnitrate, 5s. 11d. per lb. Above for cwt. lots. Extra and reduced prices for smaller and larger quantities respectively. Liquor Bismuthi, P.B., in W. Qts.—1s. 1½d. per lb.; 6 W. Qts.—11d. per lb.; 12 W. Qts.—9½d. per lb.; 36 W. Qts.—9d. per lb.

Borax, B.P.—Crystal, £24 10s. per ton. Powder, £25 *per ton. For 1-ton lots and upwards,* packed in 1-cwt. bags, carr. paid any station in Great Britain.

Bromides, B.P.—Ammonium.—1s. 10d. per lb. Potassium.—1s. 7d. per lb. Sodium.—1s. 9d. per lb. Prices for 1-cwt. lots.

Cadmium Iodide.—14s. 6d. per lb.

Calcium Hippurate.—26s.—30s. per lb.

Calcium Iodide.—20s. per lb.

Calcium Lactate, B.P.—1s. 2d.—1s. 4d. per lb., according to quantity.

Camphor.—Refined flowers, 3s. 1d.—3s. 2d. per lb. Transparent tablets, 3s. 4d.—3s. 6d. per lb., according to quantity; also special contract prices.

Chloroform.—2s. 3d.—2s. 8d. per lb.

Cinchophen.—11s. 6d.—12s. 6d. per lb.

Cocaine, Alkaloid and Citrate.—For export.—29s. 10d.—31s. 7d. per oz. Hydrochloride and Nitrate 27s. 1d.—28s. 11d. per oz.

Ephedrine hydrochloride.—5s. 6d.—6s. per oz.

Ergosterol.—2s. 6d. per gm.

Ethers.—S.G. 730, 1s. 1d.—1s. 2d. per lb., according to quantity, and other prices according to specific gravity.

Hexamine.—2s. 4d.—2s. 6d. per lb., according to quantity.

Hippuric Acid.—17s. 6d.—21s. 6d. per lb.

Hydrogen Peroxide (12 vols.).—1s. 4d. per gal., f.o.r. makers' works, naked. B.P.—10 vols., 2s.—2s. 3d *per gal.; 20 vols., 3s. per gal.*

Hypophosphites.—Calcium, 2s. 9d.—3s. 2d. per lb Potassium.—3s. 4d.—3s. 9d. per lb. Sodium 2s. 11d.—3s. 4d. per lb.

Iodine Resub., B.P.—14s. 8d.—18s. 9d. per lb.

Iodoform, B.P., Cryst., Precip. or Powder.—17s. 7d.—21s. 7d. per lb.

Iron Ammon. Citrate.—*B.P.—1s. 10d. per lb. for 28-lb* lots. Green, 2s. 6d. per lb. (list price).

Iron Iodide.—17s. 6d.—18s. per lb.

Iron Perchloride.—18s.—20s. per cwt., according to quantity.

Iron Quinine Citrate, B.P.—9¾d.—1s. 0½d. per oz., according to quantity.

Lead Iodide.—14s.—15s. per lb.

Lithium Carbonate, B.P., 1914.—5s. 4d. per lb.

Lithium Chloride, Cryst.—8s. 3d. per lb.

Lithium Citrate.—5s. 3d. per lb. Powder.—5s. 6d. per lb.

Lithium Hippurate.—18s. 6d.—22s. 6d. per lb.

Lithium Iodide.—20s. 6d.—21s. 6d. per lb.

Magnesium Carbonate.—Light, 28s. per cwt.

Magnesium Oxide.—Light, 70s. per cwt.; Heavy, 1s. 8d. per lb.; in quantity lower.

Menthol.—A.B.R., recryst., B.P., 15s. per lb. net. Synthetic, 8s. 6d.—12s. per lb. Synthetic detached crystals, 8s. 6d.—10s. 6d. per lb., according to quantity; Liquid (95%), 8s. 6d. per lb.

Mercurials, B.P.—*Red* oxide crystals, 5s. 10d.—5s. 11d. per lb.; Levig, 5s. 4d.—5s. 5d. per lb.; Corrosive sublimate, Lump, 4s.—4s. 1d. per lb.; Powder, 3s. 8d.—3s. 9d. per lb.; White precip., Lump, 4s. 9d.—4s. 10d. per lb.; Powder, 4s. 11d.—5s. per lb.; Calomel, 4s. 9d.—4s. 10d. per lb. Yellow Oxide, 5s. 2d.—5s. 3d. per lb.; Persulph., B.P.C., 4s. 11d.—5s. per lb.; Sulph. nig., 4s. 10d.—4s. 11d. per lb. Special prices for larger quantities.

Mercury, Benzoate.—8s. 3d. per lb.; Cyanide, 12s. 7d.—13s. 1d. per lb.; Oleate (5%), 1s. 11d.—2s. 2d. per lb.; (10%), 2s. 9d.—3s. per lb.; (20%), 3s. 9d.—4s. per lb. Protonitras, 6s. 9d. per lb.; Protosulphate, 7s. 3d. per lb.; Subsulphate flav., 7s. 1d. per lb.

Methyl Salicylate.—1s. 4½d.—1s. 6½d. per lb.

Paraformaldehyde.—1s. 3d.—1s. 5d. per lb.

Paraldehyde.—1s. 1d. per lb.

Phenacetin.—4s.—4s. 6d. per lb.

Phenolphthalein.—4s. 5d.—5s. 8d. per lb.

'otass. Bitartrate.—99/100% (Cream of Tartar), 80s. per cwt., less 2½%.
otass. Citrate.—B.P., 1s. 8d. per lb. for 28-lb. lots.
otass. Ferricyanide.—1s. 7½d. per lb., in 125-lb. kegs.
otass. Iodide, B.P.—13s. 15s. 6d. per lb., according to quantity.
'otass. Permanganate.—8½d. per lb. for 1-ton lots.
'otass. Metabisulphite.—50s. per cwt. d/d London, kegs free.
'otassium Hippurate.—26s.—30s. per lb.
uinine Sulphate.—1s. 10d. per oz., for 100-oz. tins, tins free.
accharin.—37s. 6d. per lb., and lower in quantity.
alicin.—15s.—16s. per lb., according to quantity.
antonin, B.P.—28s. per oz.
eidlitz powder (pulv.).—58s. 9d.—62s. 6d. per cwt.
ilver Nitrate.—1s. 3¼d. per oz. for quantity. Sticks, 2d. per oz. extra.
od. Barbitonum.—13s. 9d.—15s. per lb.
od. Benzoate, B.P.—1s. 7d. per lb., according to quantity.
od. Citrate, B.P.C., 1911.—1s. 5d. per lb. B.P.C., 1932, and U.S.P.—1s. 9d. per lb. for 28-lb. lots.
odium Hippurate.—23s. 6d.—27s. 6d. per lb.
od. Hyposulphite.—Photographic, £15 per ton d/d consignee's station, in 1-cwt. kegs.
odium Iodide, B.P.—14s.—17s. 1d. per lb.
od. Nitroprusside.—16s. per lb.
od. Potass. Tartrate (Rochelle Salt).—70s. per cwt. net for 1-ton lots. Crystals, 2s. 6d. per cwt. extra.
od. Salicylate.—Powder, 2s.—2s. 8d. per lb. Crystal, 2s. 1d.—2s. 9d. per lb.
od. Sulphide.—Pure recryst., 10d.—1s. 2d. per lb.
od. Sulphide anhydrous.—£23—£25 per ton, according to quantity, d/d U.K.
trontium Iodide.—17s. 6d. per lb.
'artar Emetic B.P.—3s. 9d.—4s. 6d. per lb.
erpine hydrate.—1s. 2d.—1s. 5d. per lb.
hymol, Puriss.—5s. 9d.—6s. 6d. per lb., according to quantity. Natural.—12s. per lb.
inc Iodide.—21s.—22s. per lb.
inc Stearate.—1s. 4d.—1s. 6d. per lb.

PERFUMERY CHEMICALS

cetophenone.—7s. per lb.
ubepine (*ex Anethole*).—8s. per lb.
myl Acetate.—2s. 3d. per lb. Amyl Butyrate.—4s. per lb. Amyl Cinnamic Aldehyde.—8s. 3d. per lb. Amyl Salicylate.—2s. 9d. per lb. Anethol, 21/22° C., 4s. 9d. per lb.
Benzaldehyde free from Chlorine.—2s. 9d. per lb.
Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. per lb. Benzyl Alcohol free from Chlorine.—2s. per lb. Benzyl Benzoate, 2s. 3d. per lb.
'innamic Aldehyde.—Natural, 12s. 3d. per lb.
'itronellol.—8s. 6d. per lb.
'itral.—6s. 6d. per lb.
'oumarin.—15s. per lb.
thyl Cinnamate.—8s. 6d. per lb.
thyl Phthalate.—2s. 6d. per lb.
ugenol.—7s. 3d. per lb. Geraniol (Palmarosa).—17s. per lb. Geraniol.—6s. 6d.—11s. per lb. Heliotropine.—6s. per lb. Iso Eugenol.—8s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 6s. 3d. per lb.—(*ex Shui Oil*) 5s. 9d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 8s. 3d. per lb.—(*ex Shui Oil*) 7s. per lb.
Iethyl Anthranilate.—9s. per lb.
Iethyl Benzoate.—4s. 6d. per lb.
Musk Ketone.—33s. per lb.
Musk Xylol.—8s. per lb.
Nerolin.—5s. per lb.
Phenyl Ethyl Acetate.—10s. per lb.
Phenyl Ethyl Alcohol.—8s. 6d. per lb.
Rhodinol.—60s. per lb. Safrol.—1s. 6d. per lb. Terpineol.—2s. per lb. Vanillin (*ex Clove Oil*).—16s.—18s. per lb.—(*ex Guaiacol*)—14s. 3d.—16s. 3d. per lb.

ESSENTIAL OILS

Almond.—Foreign S.P.A., 9s. per lb. Anise.—2s. 1d. per lb. Araucaria, 8s. 6d. per lb.—Bergamot.—6s. 6d. per lb. Bourbon Geranium.—25s. 3d. per lb.
Camphor.—Brown, 80s. per cwt.—White, 85s. per cwt. Cananga, Java, 10s. per lb. Cinnamon Oil.—3s. 6d. per lb. Cassia, 80/85%, 4s. 6d. per lb.
Citronella Oil.—Java, 2s. 9d. per lb. Ceylon, 2s. 3d. per lb. Clove.—90/92% English, 4s. 9d. per lb.
Eucalyptus, Australian B.P., 70/75%.—1s. per lb. Huon Pine (Methyleugenol, 95%), 16s. per gal. Lavender.—Mont Blanc, 38/40%.—10s. per lb. Lemon.—4s. 3d. per lb. Lemongrass.—3s. per lb. Orange, Sweet.—6s. per lb. Otto of Rose.—*Anatolian*, 37s. 6d. *per oz.*; *Bulgarian*, 55s. *per oz.* Palma Rosa, 9s. per lb.
Peppermint.—Japanese, 6s. 6d. per lb. Wayne County, 14s. per lb. Petitgrain.—5s. 9d. per lb.
Sandalwood, Mysore.—30s. per lb. 90/92%, 20s. per lb. Australian, B.P. and French Codex, 92/95%, 15s. 3d. per lb.

INTERMEDIATES

Items marked thus * d/d buyers' works.

*Acid, Benzoic, 1914 B.P. *ex Toluol*.—1s. 9½d. per lb. in casks.
*Acid Gamma.—Spot, 4s. per lb., 100%.
*Acid H.—Spot, 2s. 4½d. per lb., 100%.
*Acid Neville and Winther.—Spot, 3s. per lb., 100%.
*Acid Sulphanilic, 8d. per lb.
*Aniline Oil, spot, 8d. per lb., drums extra.
*Aniline Salts, spot, 8d. per lb., casks free.
*Benzaldehyde, spot, 1s. 8d. per lb., packages extra.
*Benzidine Base.—Spot, 2s. 5d. per lb., 100%.
o-Cresol 30/31° C.—£2 6s. 5d. per cwt. in 1-ton lots.
m-Cresol 98/100%.—2s. 3d. per lb., in ton lots.
p-Cresol 34.5° C.—1s. 9d. per lb., in ton lots.
Dichloraniline.—2s. 3d. per lb.
*Dimethylaniline.—Spot, 1s. 6d. per lb., packages extra.
Dinitrobenzene.—8d. per lb.
Dinitrotoluene 48/50° C.—8d. per lb. 66/68° C.—8¾d. per lb.
*Diphenylamine.—Spot, 2s. per lb.
*α-Naphthol.—Spot, 2s. 4d. per lb.
*β-Naphthol.—Spot, £78 15s. per ton, in paper bags; £79 15s. per ton in casks, in 1-ton lots.
*α-Naphthylamine.—Spot, 11½d. per lb.
*β-Naphthylamine.—Spot, 2s. 9d. per lb.
o-Nitraniline.—5s. 10d. per lb.
**m*-Nitraniline.—2s. 7d. per lb.
**p*-Nitraniline.—Spot, 1s. 8d.—2s. 1d. per lb.
*Nitrobenzene.—Spot, 4½d. per lb., 5-cwt. lots, drums extra.
Nitronaphthalene.—9d. per lb.
*Sodium Naphthionate.—Spot, 1s. 9d. per lb., 100%.
**p*-Toluidine.—Spot, 1s. 11d. per lb.
**o*-Toluidine.—Spot, 9½d. per lb., drums extra.
m-Xylidine acetate, 3s. 4d. per lb., 100%.

PATENT LIST

The following is a list of complete specifications of chemical interest which are open for inspection under Section 91 (4) (a) of the Patent Acts. Printed copies are not available, but photographic copies may be obtained at a charge of 8d. per page (minimum 1s.) from the Patent Office, Chancery Lane, W.C.2.

I. 32,283 (1932). Aktieb. Filtrum. Valves for controlling liquid flow.

32,447—9 (1932). Babcock & Wilcox, Ltd. Pulverizing mills.

32,640 (1932). Oberadische Treuhand-Ges. Gleichauf & Dr. Helbig. Methods of operating furnaces.

II. 26,475 (1932). N. V. de Bataafsche Petroleum Maats. Manufacture of viscous oil by condensation of cracking products.

29,127 (1932). Standard Oil Development Co. *See* III.

32,418 (1932). Wiedermann. *See* IX.

III. 29,127 (1932). Standard Oil Development Co. Grignard synthesis.

31,935—6 (1932). Soc. Chem. Ind. in Basle. Manufacture *of intermediate products and dyestuffs.*

32,286 (1932). Du Pont de Nemours & Co. Manufacture of anthraquinone-acridones.

32,900 (1932). Puranen and Erhnrooth. Producing from cymol or its derivates a hydrocarbon etc. with a larger molecule.

IV. 31,935—6 (1932). Soc. Chem. Ind. in Basle. *See* III.

V. 6097 (1932). Soc. Anon. Cartiere Giacomo Bosso, and Silvestrini. Production of decorative materials etc. from fibrous cellulose materials.

30,048 (1932). Industrial Products Corp. Recovery of pulp from waste paper.

VI. 32,831 (1932). Brit. Celanese, Ltd. Treatment of *textile materials.*

VII. 32,711 (1932). Titanium Pigment Co. *See* XIII.

32,868 (1932). Briner and Wakker. Fixation of nitrogen by means of an electric arc.

VIII. 2971 (1932). Behr–Manning Corp. Manufacture of abrasive articles.

30,454 (1932). Fechoz. Glass furnaces.

32,158 (1932). Nielsen. Manufacture of bricks.

32,892 (1932). Soc. Anon. des Manuf. des Glaces et Produits Chimiques de St. Gobain, Chauny & Cirey. Tempering glass.

IX. 32,418 (1932). Wiedermann. Production of road coverings.

X. 24,332 (1932). Aluminum Colors, Inc. Treatment of the surfaces of *aluminium* or *aluminium* alloy articles.

28,601 (1932). Bacon. Roasting pyrites fines.

30,183 (1932). Soc. Anon. le Carbone. Manufacture of metallic powder.

32.436—7 (1932). Amer. Rolling Mill Co. Preparing metal articles for coating.

32,874 (1932). Internat. Gen. Electric Co. Electrolytically producing endless metal bands.

XI. 16,830 (1932). N. V. Philips' Gloeilampenfabr. Photo-electric cells.

*32,082 (1932). Radio A.-G. D. S. Loewe, and Wald*schmidt. Producing high-emission thermionic cathodes.

32,464 (1932). Radio A.-G. D. S. Loewe, and Waldschmidt. Producing electric-discharge tubes.

32,868 (1932). Briner and Wakker. *See* VII.

32,871 (1932). Brit. Thomson-Houston Co. Electric insulating materials.

32,874 (1932). Internat. Gen. Electric Co. *See* X.

XIII. 32,402 (1932). Consort. f. Elektrochem. Ind. Ges. Manufacture of shaped articles from polyvinyl alcohols.

32,711 (1932). Titanium Pigment Co. Compos titanium pigments.

XIV. 19,144 (1932). Kleinert Rubber Co. Producti *of rubber goods.*

XVII. 32,767 (1932). Aktieselskabet Dansk Gærin Industri. *See* XVIII.

XVIII. 32,767 (1932). Aktieselskabet Dansk Gærin Industri. Producing spirits by fermentation materials containing carbohydrates.

XIX. 32,575 (1932). Hanseatische Mühlenwerke A.- *Production of cheese.*

XXI. 32,179 (1932). Gaspar. Producing 3-colour pho graphs and kinematographic films.

32,191 (1932). Gaspar. Production of a colour sound film.

32,768 (1932). Soc. d'Etudes de Nouveautés Ciném et Photographiques. Photography in relief.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development a Intelligence), 35, Old Queen Street, London, S.W has received the following inquiries for British goo British firms may obtain further information by app ing to the Department and stating the specific numb *Argentina:* Iron and steel sheets and tin plates (79 *Australia:* Chemicals (753). *Brazil:* Gum-Arab tragacanth gum, red and white lead (800). *Canad* China clay, barytes, sodium sulphate and alum (75 *Egypt:* Paint (B.Y. 7579). *Italy:* Oxide of zinc (777 Industrial chemicals (778). *Jamaica:* Soap (76 *Portuguese West Africa:* Paint (791). *Rumani* Chemicals, aniline dyes, zinc ingots, pig iron, (78 *South Africa:* Fertilizers (767). *Turkey:* Laborato instruments, photographic materials, aluminium, ste varnish, paint, lubricating oil (797).

Import Duties Advisory Committee

The Import Duties Advisory Committee gives not that it has under consideration applications for increa in the import duties on: condensed milk, milk powd lactose, and fruit pectin.

The Committee is considering also the adjustment the duties on brown artificially fused aluminium oxi and natural emery garnet and corundum in grain, a the addition to the free list of artificially fused alumini oxide, brown artificially fused aluminium oxide, a natural garnet and corundum.

Representations in regard to these matters should addressed to the Secretary, Import Duties Adviso Committee, Caxton House (West Block), Tothill Stre Westminster, London, S.W.1, not later than June 19.

General Electric Co.

In the advertisement of the General Electric Co., Lt appearing on p. xvi of the last issue of the JOURNA the thermostat illustrated in the top right-hand corn of the page was erroneously described as an instrume for controlling the temperature of liquids. The therm stat in question is designed to control automatica the temperature of rooms and cupboards.

Change of Address

The office address of Dr. A. J. V. Underwood is n 38, Victoria Street, London, S.W.1; the telepho number, Victoria 7811, remains unchanged.